DIFFERENCES IN JOB GROWTH AND PERSISTENCE IN SERVICES AND MANUFACTURING*

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Abstract

Employment flows in services have greatly exceeded those in manufacturing over the recent decade. We examine these differences and their variation over establishment sizes and types. We test three hypotheses which have been offered to explain these differences: (1) that the difference in behavior of single and multi-unit establishments accounts for much of the difference in the net and gross growth rates of jobs in services and manufacturing; (2) that relative wage differences have a disparate effect on employment growth for services and manufacturing, and (3) that the rates of persistence (or retention) of new jobs are higher in multi-unit establishments than in single unit firms, and similar between the sectors after controlling for this. We find that it is primarily the underlying differences in establishment age and size distributions that account for the substantial differences in the average gross and net job flow rates of the two sectors, and that relative wage differences have a similar effect on employment growth in services and manufacturing.

Key Words: Gross Job Flows, Growth, Persistence, Wages, Services, Manufacturing.

JEL Classification: J6 L6 L8 M13

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I. Introduction

> *"The world that once seemed rich and ripe with potential, has become for many, a place full of fear---for their jobs, for their retirement and especially for their children." NYT 1996*[1]

In many countries there is widespread concern among economists, policy makers and the general public alike about the dynamics of the service sector. The conventional wisdom is that service businesses behave differently from manufacturing businesses, generating predominantly unstable and low-wage jobs. According to Griliches (1995) the slowness of productivity growth in services, together with its rising share in nominal GNP and in total employment, has been a major drag on the productivity growth of the overall economy and its competitive performance. However, there has been little analysis of these suspected differences in business dynamics between services and manufacturing.[2] The lack of comprehensive data has discouraged researchers from focusing on whether, or how, the employment growth and stability of the service sector differs from that of manufacturing.

Market economies experience high rates of job creation and job destruction in nearly all time periods and sectors.[3] Each year, many businesses expand while others are contracting. New businesses constantly enter, while older ones abruptly exit or

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[1] *The New York Times*, "In the class of '70' Wounded Winners," The Downsizing of America, Fifth of seven articles, March 7, 1996, p.1.

[2] For a recent analysis of job flows in retail and hospitality services in the Netherlands, see Klomp and Thurik (1999).

[3] A long standing view holds that economic growth in a market economy inevitably involves reallocation. Schumpeter (1942) coined the term, "creative destruction," to describe this evolutionary process. Creative destruction models of economic growth stress that the process of adopting new products and new processes requires the destruction of old products and processes. See, for example, Aghion and

gradually disappear. A large literature now exists in both industrial organization and labor economics that examines issues of gross job flows. [4] During the 1990s, a number of studies have examined the impact of size and age on various measures of firm growth -- usually employment.[5] Most studies have found that gross job flows decline with age, after controlling for size, and gross job flows decline with size for establishments that entered at the same time. Recent reviews of this literature are provided by Davis and Haltiwanger (1999), Caves (1998) and by Sutton (1997). These reviews point out that, while our general understanding of business dynamics has increased, many important issues remain. One cluster of such issues is the explanation of variation in post-entry performance of firms and establishments. Post-entry performance may be viewed as the outcome of the selection process of markets that enables some firms to survive and grow, while others stagnate and ultimately exit (Mata and Audretsch, 1995).

There are three important issues in gross job flow analysis that are not bridged in the industrial organization and labor economics literature. The first arises from their different traditional units of analysis. In industrial organization the unit of analysis is a business. Questions focus on the entry, survival and growth of the business. There are rarely questions concerning the quality or stability of the jobs that are created. In labor economics, the unit of analysis is most often employment, and the question of job quality (skilled or unskilled, stable or unstable, well paid or not) is frequently central to

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Howitt (1992), Caballero and Hammour (1994 and 1996), Campbell (1997), and Helmstadter and Perlman (1996).

[4] Several recent empirical studies of plant-level and firm-level productivity behavior provide direct evidence on the role of factor reallocation in productivity growth (Olley and Pakes, 1996)

[5] Most of this literature has been motivated by the theoretical work of Simon and Bonini(1958), Lucas (1978), Jovanovic (1982), Jovanovic and MacDonald (1994) and Nelson and Winter (1982), among

the analysis (Davis and Haltiwanger, 1999).[6] Indeed, much of the debate about job creation on both sides of the Atlantic has focused on the issue of job quality (Krueger and Pischke, 1997).

Second, while the various models of business dynamics posited by theoretical economists are independent of industry sector, empirical economists have generally analyzed only the dynamics of the manufacturing sector of the economy (Dunne, Roberts and Samuelson, 1989a and 1989b; Davis and Haltiwanger, 1992; Baldwin, 1995; and Audretsch, 1995). This sector typically has high paying jobs and increasing productivity, along with stable or decreasing employment. However, three-quarters of the jobs created over the past decade have been in the service sector. To what extent is analysis of the manufacturing sector applicable to the service sector, which is generally thought to have low paying jobs and stagnant productivity, along with massive growth (Acs and Armington, 1999)? This question remains unanswered, since there has been scant data on which to base such an assessment.

Third, neither labor economics nor industrial organization has been concerned with the role of the entrepreneur in industry dynamics (Reynolds and White, 1997). A close examination of manufacturing and services suggests that entrepreneurs may be playing different roles in the two sectors. The high rate of new firm startups and the dominance of single-location businesses in services suggest that control of much of the service sector is in the hands of owner-operators. Some of these are innovators and risk-takers. Others are risk-avoiding owners of "life-style" small businesses that hope to

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others. Early empirical tests of firm growth by Evans (1987), and Dunne, Roberts and Samuelson (1989a and 1989b), and many others since, have found consistent results with respect to age and size.

survive in the niche they originally carved out for themselves. The manufacturing sector, on the other hand, is predominately controlled by professional managers for multi-unit firms. While many of these managers are highly skilled and experienced, they must frequently operate within a slow-moving, risk-avoiding bureaucracy. Their larger firms may provide easier access to capital, but their typically higher sunk costs render them less flexible, and perhaps less entrepreneurial. Whether an establishment is independently run by its owner/proprietor, or is part of a multi-unit enterprise run by professional managers, may be very important for predicting its post-entry performance.[7]

We examine business dynamics in services and manufacturing using a recently constructed database that facilitates tracking of employment and ownership changes in all private sector U.S. businesses (Acs and Armington 1998). This allows us to address three important questions about the similarities and differences in *employment dynamics* and the *post entry performance* of businesses in manufacturing and in services. First, do services behave differently than manufacturing firms? Second, can differences in their performance be attributed to the predominance of single-location firms in services, versus multi-location firms in manufacturing? Third, are there systematic differences in the stability of the new jobs that these firms create, in terms of their persistence?

This paper extends the traditional model of firm growth to control for differences in job quality across sectors, comparing manufacturing with services, and looking at the

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[6] In labor economics, issues of firm entry are seldom discussed with the emphasis being on long-run equilibrium, cycles, and growth.

[7] If the economy exhibits constant returns to scale then an increase in population would also require an increase in entrepreneurial talent to keep wages from falling (Krueger and Pischke, 1997).

behavior of single and multi-unit establishments separately. It was anticipated that type would be influential because single unit establishments are more frequently owner-operated and poorly financed, while establishments that belong to multi-unit firms are controlled by professional managers with limited liability and greater financial resources (Evans and Jovanovic, 1989). The econometric analysis tests three hypotheses: (1) that the difference in behavior of single and multi-unit establishments accounts for much of the difference in the growth and stability of jobs in services and manufacturing; (2) that relative wage differences have a disparate effect on employment growth for services and manufacturing, and (3) that the persistence rates of new jobs are higher in multi-unit establishments than in single unit firms, and similar between the sectors after controlling for this.

In section two the longitudinal establishment data are introduced and the gross and net job growth rates are defined. An overview of the differences in employment structure and growth in services and manufacturing businesses is presented in section three. The fourth section presents the theoretical approach, and then develops and estimates an empirical model to account for differences in establishment growth. The fifth section examines the differences in the average persistence of job gains from births and from expansions in the two sectors, and in the two types of firms – single location and multi-unit. The sixth section summarizes our conclusions.

We find that industries with higher average pay have slightly reduced job creation rates and substantially reduced job destruction rates. This is contrary to the popular perception of America losing primarily its higher paid jobs in recent years.

II. The Data and Measurement of Establishment Growth Rates

A. The Longitudinal Enterprise and Establishment Microdata (LEEM)

The Longitudinal Establishment and Enterprise Microdata (LEEM) file has multiple years of annual data for each U.S. private sector (non-farm) business with employees. The current LEEM file facilitates tracking employment, payroll, and firm affiliation and (employment) size for the more than eleven million establishments that existed at some time during 1989 through 1996. This file was constructed by the Bureau of the Census from its Statistics of U.S. Business (SUSB) files,[8] which were developed from the economic microdata underlying Census' County Business Patterns. These annual data were linked together using the Longitudinal Pointer File associated with the SUSB, which facilitates tracking establishments over time, even when they change ownership and identification numbers.[9]

The basic unit of the LEEM data is a business establishment (location or plant). An establishment is a single physical location where business is conducted or where services or industrial operations are performed. The microdata describe each establishment for each year of its existence in terms of its employment, annual payroll, location (state, county, and metropolitan area), primary industry, and start year. Additional data for each establishment and year identify the firm (or enterprise) to which the establishment belongs, and the total employment of that firm.

A firm (or enterprise or company) is the largest aggregation (across all industries) of business legal entities under common ownership or control. Establishments are

[8] The SUSB data and their Longitudinal Pointer File were constructed by Census under contract to the Office of Advocacy of the U.S. Small Business Administration. For their documentation of the SUSB files, see Armington (1998).

owned by legal entities, which are typically corporations, partnerships, or sole proprietorships. Most firms are composed of only a single legal entity that operates a single establishment—their establishment data and firm data are identical, and they are referred to as "single unit" establishments or firms. The single unit businesses are frequently owner-operated. Only 4 percent of firms have more than one establishment, and they and their establishments are both described as multi-location or multi-unit. Multi-unit firms may be composed of one or more legal entities. Most are corporations that are managed by professional managers, rather than owner-operators.

Establishments that continue their operations can usually be tracked through time using the LEEM, even if their identification numbers are changed due to changes in their location, firm type, legal form, or ownership. Therefore, it is generally possible to clearly identify the startup (birth) of a new establishment or the termination (death or closure) of an establishment, as distinguished from the appearance of a new identification number or the discontinuance of an old one.

For this study of changes in service and manufacturing establishments, we included all U.S. establishments in the LEEM with positive employment in any year from 1989 through 1995 if their most recent industry classification was in the non-financial services sector or in manufacturing. These comprise Standard Industrial Classifications (SIC) 7000 through 8999 for services and SIC 2000 through 3999 for manufacturing.

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[9] These LEEM data are housed at the Center for Economic Studies at the U.S. Bureau of the Census. For a more complete description of the LEEM, see Acs and Armington (1998).

B. Definition of gross and net job flow rates

Using annual data on employment in each establishment, we can calculate gross job flows for various categories of businesses, in addition to their net job growth. However, the annual employment change calculated for each establishment represents only the net change that year (March to March) in number of employees in that establishment. Some positions may have been eliminated and others created without any net change in employment, so the annual gross job change rates for establishments will understate the true rates of gross job creation and destruction in the economy.

For any specified class of establishments, we identify the following gross job flows relative to a base year, t:

B(t+1) = Births or startups -- employment in period t+1 in all establishments with positive employment in t+1 and no employment in t;

$\Delta X = X(t+1) - X(t)$ = Expansions -- employment change from period t to t+1 for all establishments with positive employment in t and larger employment in t+1;

$\Delta C = C(t) - C(t+1)$ = Contractions -- employment change between period t and t+1 for all establishments with positive employment in t and smaller, but positive, employment in t+1;

D(t) = Deaths or closures – employment in period t in all establishments with positive employment in t and no employment in t+1.

If the total employment in year t is designated as E(t), then the net change in employment between two consecutive years is calculated as:

$$\Delta E = E(t+1) - E(t) = \Delta X + B(t+1) - D(t) - \Delta C.$$

The sum of the absolute value of all gross job flows is called the gross reallocation of jobs between t and t+1, and it may be thought of as the total turnover in jobs, which are contemporaneously created in some establishments and destroyed in others.

The mean employment of all establishments during the period from t to t+1 is:

(1) $M(t, t+1) = (E(t) + E(t+1)) / 2$

We define job flow rates (designated by the corresponding lower case letters) by dividing each of the change amounts by the mean employment. Thus, we have:

$b(t+1) = B(t+1) / M(t, t+1)$

$x = \Delta X / M(t, t+1)$

$c = \Delta C / M(t, t+1)$

$d(t) = D(t) / M(t, t+1)$

for birth, expansion, contraction, and death rates. The gross job creation rate is the sum of the positive job flow rates:

(2) $Create = b + x = (B(t+1) + \Delta X) / M(t, t+1)$.

The gross job destruction rate is the sum of the negative flow rates:

(3) $Destruct = c + d. = (D(t) + \Delta C) / M(t, t+1)$.

The corresponding gross reallocation rate is then:

$Realloc = b + x + c + d = Create + Destruct$.

The net employment growth rate is:

(4) $Net = \mathbf{DE / M} = b + x -- c – d = Create - Destruct$.

These mean-based growth rates are a convenient approximation to the

continuous, or compounded, growth rate.[10] Use of the mean as the divisor for calculating growth and flow rates avoids the problems of asymmetry and unbounded range in more traditional discrete-time rates (calculated by dividing change by the total number of jobs in the initial period). The mean-based job flow rates vary from a maximum of 200 percent for establishment births, to a minimum of –200 percent for net job loss from establishment deaths.

III. Employment Differences in Services and Manufacturing

Employment in the service sector in 1995 was almost double that of the manufacturing sector, and accounted for about a third of total private nonfarm employment in the U.S. The structure of the service sector was quite different from that of the manufacturing sector. These differences may reflect inherent differences in their economic activity, or may simply be the result of the different stage of maturity of businesses in these sectors. Table 1 provides data for comparison of the 1995 distributions of employment in services and manufacturing establishments by size and type of establishment.

Single unit establishments predominate in services (53% of employment) while manufacturing is predominately in establishments that belong to multi-unit firms (71%). However, the share of services' employment in multi-unit firms has increased 4 percentage points since 1989, while that of manufacturing has fallen slightly.[11] This

[10] The continuous growth rate is calculated as the difference in the natural logarithms of the employment levels: ln E(t+1) – ln E(t). Its values are virtually identical to those of the mean-based rate for changes below 10 percent, and are similar for changes up to 100 percent. The continuous rate is not defined for births or deaths, because the log of zero is not defined. Both calculations have the merit of symmetry, so that the rate of change from a to b will have the same value (with the opposite sign if net) as a change from b to a. The mean-based rate has the additional merit of being additive, so that the net growth rate can be calculated as the sum of the birth and expansion rates, less the death and contraction rates.

[11] The share of services employment in firms with at least 1000 employees also increased by 4 percentage points during this period, while that of manufacturing fell about a point.

trend toward convergence should probably be taken as evidence of the maturing of many of the firms in the service sector, and rejuvenation of the more innovative portions of the manufacturing sector (Acs and Audretsch, 1989).

The two sectors also differed considerably in the distribution of their employment by size of establishment. Nearly 16% of employment in services was in establishments with less than 10 employees (not shown), while less than 4% of manufacturing employment was in such tiny establishments. Unlike manufacturing, many service activities have little or no potential for economies of scale, so that such tiny establishments can be competitive economic units for producing services.

Table 1
1995 Employment in Services and Manufacturing Establishments Distributed by Size and Type of Establishment

Percent of total employment within each sector

	Services	Manufacturing
All Sizes		
Establ. in single unit firms	53.3%	29.0%
Establ. in multi-unit firms	46.7%	71.0%
All establishments	100.0%	100.0%
Small establishments (less than 50 empl)		
Establ. in single unit firms	29.9%	14.4%
Establ. in multi-unit firms	9.5%	3.8%
All establishment types	39.0%	18.2%
Medium establishments (50-999 empl)		
Establ. in single unit firms	19.0%	14.2%
Establ. in multi-unit firms	23.9%	46.7%
All establishment types	42.9%	61.9%
Large establishments (1000 or more empl)		
Establ. in single unit firms	4.8%	0.4%
Establ. in multi-unit firms	13.3%	20.5%
All establishment types	18.1%	20.9%
Industry employment in 1995	34,699,618	18,608,637

Source: Tabulation of the 1989-1995 Longitudinal Establishment and Enterprise (LEEM) file, which was prepared by the Bureau of the Census, U.S. Department of Commerce.

The share of service employment in establishments with less than 50 employees was more than double that for manufacturing. Manufacturing employment is concentrated in medium-sized establishments, with over 60% in establishments with 50 to 999 employees. Only 43% of services' employment was in this medium size-class. However, in the largest size-class the two sectors were remarkably similar, each with around 20% of their employment in establishments with at least 1000 employees.

The shares of services' employment in single unit firms in every size-class greatly exceeded those for manufacturing employment. Single unit service firms with at least 1000 employees, such as large hospitals and private universities, accounted for nearly 5% of service employment. In manufacturing less than half a percent of employment was in such large single-unit firms.

Average annual growth rates, and their gross flow components, are shown in Table 2. Between 1989 and 1995 service employment grew by 3.8% annually while manufacturing employment declined by 0.9 percent annually. Comparing the sectors' overall performances (all firm types), the flow rates in services were higher than those in manufacturing for each of the components of growth and reallocation.

Looking at the detailed rates by sector and firm-type, note first that the job destruction rates are very similar for the two sectors. The sector difference between destruction (death and contraction) rates for establishments in multi-unit firms was only one point, and for single unit firms these destruction rates were nearly identical for the two sectors.

The 1989-1995 performance of single and multi-unit establishments in services and manufacturing shows that every component of growth (expansion, birth, death, and

contraction) is higher for single units than for multi-units. The greatest differences are found between the job creation rates for multi-unit establishments. Their manufacturing expansion rate was 4 percentage points lower than that of multi-unit services. Manufacturing job creation from births of multi-unit locations was three points lower than services. It appears that destruction rates vary more by firm-type than by industry, but large industry differences remained among job creation rates after controlling for firm-type. Therefore, the overall higher average growth rates in services cannot be attributed solely to services' higher proportion of faster growing single-unit establishments.

Focusing just on average job growth rates from existing establishments, the bottom line of Table 2 makes it clear that in both sectors, *existing establishments destroy more jobs than they create*. Existing services establishments lose an average of 2.4 percent of their jobs each year, while existing manufacturing establishments lose an average of 3.8 percent of theirs. These averages are virtually the same for single unit firms and for establishments that belong to multi-unit firms. The great variation in net growth rates for the sectors, and for the two types of establishments, is apparently springing primarily from the large differences in rates of job creation from establishment births, the outcome of entrepreneurial activity.

IV. Explaining Differences in Gross and Net Employment Change Rates

A. Theory

In this paper, we extend the traditional model of firm growth (Evans, 1989) to control for differences in job quality across industries. The model growth relationship is given by:

(5) $\mathbf{DE/M} = G(\mathbf{S}_t, \mathbf{A}_t, \mathbf{W}_{ind}, \mathbf{X}_{ind})$

where $\mathbf{DE/M}$ is the mean-based employment growth rate as defined in equation (4) above, **S** is establishment size, **A** is establishment age, **W** is the industry relative pay ratio and **X** is a vector of industry characteristics. Establishment size has been consistently found to be negatively related both to gross job creation and to gross job destruction. Its effect on net job growth, which is the difference between these two negative effects, is small and inconsistent in sign, depending on the form of the model and the classification. As with many other economic variables, it seems to be proportional differences in

Table 2
Net and Gross Job Creation Rates by Establishment Type and Sector
1989-1995 Average annual mean-based percentage change rates

	Single Units		Multi-units		All Types	
	Services	Manufactures	Services	Manufactures	Services	Manufactures
Net Growth	**4.5**	**1.4**	**2.9**	**-1.7**	**3.8**	**-0.9**
Expansion	12.2	11.4	10.2	6.4	11.2	7.8
Birth	7.0	4.9	5.2	2.2	6.2	3.0
Death	5.7	5.6	3.6	2.7	4.7	3.5
Contraction	9.0	9.3	8.8	7.7	8.9	8.1
Reallocation	33.9	31.3	27.8	19.0	31.1	22.5
Net excl. Births	**-2.5**	**-3.5**	**-2.3**	**-4.0**	**-2.4**	**-3.8**

Source: Tabulation of the 1989-1995 Longitudinal Establishment and Enterprise (LEEM) file, which was prepared by the Bureau of the Census, U.S. Department of Commerce.

size that affect growth rates similarly, so the natural logarithm of the employment size is linearly related to the growth rates.[12]

Establishment age has also been found to be negatively related to both creation and destruction rates. The fall in average expansion rates with increasing age is slightly less than the fall in contraction and failure rates, so that age has consistently shown a tiny positive effect on net job growth rates. Our prior work[13] has shown that it is proportional differences in age that affect growth rates linearly, so the logarithm of age will be used in our models. Of course, the job creation from births adds a non-linear spike to the age-growth relationship, since all births occur at age one, and all of their employment change is positive, with a growth rate of 200%. A birth dummy is used to capture this fixed effect of births on creation rates.

Industry pay serves as a proxy variable for job quality and human capital investment in each industry. Higher levels of pay indicate that the industry requires workers with higher education, more training, or uncommon skills. Since our analysis does not extend beyond 1995, it seems reasonable to assume that there was no widespread shortage of workers, so the supply of workers was not restricted. We also assume that employers have set their pay rates to attract the quality of worker needed for their operations[14], and the average for an industry then provides a measure of the quality of workers and their average level of compensation. We further assume that the

[12] This implies that the difference between the expected average job creation rates of establishments that have, for instance, 10 and 15 employees will be the same as the expected difference for establishments with 200 and 300 employees.
[13] Acs, Armington and Robb (1999).
[14] We observe only the number of employees (or filled positions) in each establishment in March of each year, and have no information on vacancies, which might disprove this assumption.

relative pay relationships between industries do not change over the period from 1989 through 1995.

This context does not lead to any specific expectations about the relationship of pay to job growth rates. It is commonly thought that job creation in the early 90's took place disproportionately in low wage jobs and that job destruction has taken place predominately in high wage jobs. Evidence for this is found both in the popular press and in academic research as well.[15] If jobs are being created primarily in low wage sectors of the economy, we would expect the sign on average pay to be negative for job creation. The sign should be positive for job destruction if jobs are being destroyed disproportionately in high wage sectors of the economy (Nickell and Bell, 1995). The net effect of the pay differentials on net employment growth will be negative if they are negative for creation and positive for destruction.

There are conflicting theories about whether single or multi-unit firms are more likely to foster innovation and growth, leading both to higher net growth and higher reallocation rates. Support for greater expected growth in single unit firms comes from the entrepreneurial literature, which focuses on young single unit firms as the embodiment of innovation in products, services, processes, or markets (Audretsch, 1995). These firms enter the economy taking substantial risks and hoping for substantial returns. As they learn more about their competitive position they may either withdraw, or expand and thrive. The establishments that belong to multi-unit firms are generally run by a bureaucracy of professional managers, who tend to be risk averse, even though they have limited financial liability. The owner-operators who control most

[15] See, for instance, OECD (1994), Davis Haltiwanger and Schuh (1996) pp.43-47, *The New York Times*, "The Downsizing of America," 1996.

single location firms may be willing to take on greater risks, and able to respond more quickly to perceived problems and opportunities. These factors should also lead to both higher net growth rates and higher job reallocation rates among single-unit firms (Jovanovic 1982).

However, many of the older single unit firms are so-called "life-style" businesses, whose owner-operators are content to merely survive in a comfortable business until retirement, with minimum risk and little interest in growth. Because most multi-unit firms are incorporated, they have limited liability and may therefore take on greater risks, with deeper financial backing. Some of the industrial organization literature has focused on comparison of the relative growth rates and stability of limited liability corporations, in contrast to non-incorporated firms, and found that the limited liability firms tend to have both higher growth rates and higher death rates.[16]

B. Model

Much previous research on the relationship of job generation to business size has been limited by data constraints to use of either establishment size, or total size of the entire firm, regardless of whether the relevant theory was dealing with plant (establishment) size or firm size. The LEEM data provide both measures of business size, for each year of data. We therefore carefully tested the use of both in a recent related analysis of job creation in all sectors during this period (Acs, Armington and Robb, 1999). We found that after controlling for the size and age of establishments and the type of firm (single-unit or multi-unit), differences in the size of the firm owning the establishments

[16] This is advanced in Stiglitz and Weiss (1981) and demonstrated by Harhoff, Stahl, and Woywode (1998), using German data on firms in all sectors.

contribute little to explaining differences in gross or net job flows. That is, firm size is insignificant in explaining job growth, except to the extent that it is closely correlated with establishment size (especially in single units, where the firm and the establishment are identical). Therefore, firm size is not included in our model.

In order to distinguish the influences of the multiple factors that affect gross and net job flow rates, we develop a model expressing each job flow as a function of these factors and other control variables. Observations on individual establishments are aggregated into cells classified according to their initial employment size in the observation period, age, two-digit industry, year of observation, and firm type (single or multi-unit).[17] For each annual observation period, the mean employment of the establishment (using formula 1 above) and any positive or negative employment change during the observation year are accumulated for all establishments in each cell. These are used (with formulas 2, 3, and 4) to calculate the average rates of gross job creation and destruction and net job growth for all establishments in that cell in that period. Our regression models then analyze how these measures of gross and net change vary across the cells[18], as functions of the characteristics defining the cells.

For each year t, varying from 1989 through 1994, all establishments that had positive employment in year t or year t+1 are assigned to the appropriate cell, defined according to the following characteristics:

[17] In order to construct a model of growth that is useful for predicting average rates of job flows and net employment changes for various classes of businesses, we will use initial size for classification of establishments for analysis. For a discussion of initial vs mean classification see Acs, Armington and Robb (1999).

[18] It should be noted that these average data for cells are not samples, but represent the entire universe of establishments in manufacturing and services in each period, classified by similar characteristics.

1) 9 initial employment classes, based on the establishment's employment in year t, except for births' employment in year t+1 (first non-zero employment): 1-4 employees, 5-9, 10-19, 20-49, 50-99, 100-249, 250-499, 500-999, or 1000 or more.
2) 7 age classes, based on the difference between t+1 and the reported "start year" of the establishment: births[19], others with age less than 3 years, 3-4 years, 5-7, 8-10, 11-15, 16 or more years.
3) 35 2-digit SIC classes (20 manufacturing and 15 services industries).
4) 6 time periods, t.
5) 2 firm types: single and multi-unit (using multi if the establishment was multi-unit in either year t or year t+1).

For each of the three-job flow rates (creation rate, destruction rate, and net growth rate), coefficients are estimated for an equation that is an expanded form of equation 5 above, with regressors including explanatory and control variables. Again, we use t to designate the initial year of each interval for which job flows are calculated:

(6) $$\text{flow rate} = b_0 + b_1 \textbf{Log Empl}_t + b_2 \textbf{LogAge}_{t+1} + b_3 \textbf{RelPay}_{Ind} + b_4 \textbf{GDPchg}_{t,t+1} + b_5 \textbf{IndGro}_{Ind} + b_6 \textbf{LogTaxEx}_{Ind} + b_7 \textbf{Birth}_{t+1} + b_8 \textbf{MU}_{t+1} + b_9 \textbf{Serv} + u$$

where **LogEmpl** is employment size defined as the cell average of the natural logarithm of initial establishment employment. **LogAge** is the age of establishments, defined as the cell average of the natural logarithm of their age in years. **RelPay** is the industry relative pay differential, defined as the difference between the average annual

[19] Because we do not recognize an establishment birth until it has reported positive (March) employment, any births that hire their first employee after March will have a calculated age of 2 years in their first year as employers. We reset their age to 1, so that the log of their age will be zero.

payroll[20] in 1992 for all establishments in each 2-digit SIC that existed during 1991-1993[21] and the corresponding average pay for all covered industries, divided by the average pay for all covered industries**.** **GDPchg** is the national GDP growth rate from t to t+1**.** **IndGro** is the trend rate of growth of each industry, defined as the 1989-1995 average annual employment growth rate for the 2-digit SIC. **LogTaxEx** measures the share of the industry's employment in tax exempt firms, defined as natural log of one plus the percent of employment in tax-exempt firms in 1987 (Census data for services only). **Birth** is a dummy with a value of one for the cells containing establishment births.[22] **MU** is a multi-unit dummy, defined as 1 if the cell contains establishments that were multi-units in either year t or t+1. **Serv** is a services dummy, defined as 1 if the cell contains establishments in the service sector. **u** is a stochastic disturbance representing measurement errors and uncorrelated missing variables.

The primary explanatory variables in this model of job growth -- Employment size, Age, and Relative Pay – have been discussed above. The remaining exogenous variables serve primarily as controls. GDPchg provides for differences over time in the rate of change in the general economic climate within which all these businesses operate. We would expect gross job creation and net growth to be positively related to annual changes in GDP, and job destruction to be negatively related.

Industry growth trends account for the impact on employment of longer-term changes in demand for each industry's output and other changes in that industry's

[20] This is calculated for 1992 as the sum of reported annual payroll in the industry divided by reported employment. Since some employees are part-time, it will under-report full-time pay rates. However, according to tabulations from the March Current Population Survey, the proportions of part-time employment in services are not substantially higher than those in manufacturing, so the relative pay relationships should be roughly accurate anyway.

[21] This eliminates part-year employment in start-ups and closures from the calculation.

demand for labor due to process (productivity) changes. Gross job creation is expected to be positively related to the growth trend in each 2-digit industry, with a coefficient greater than one. Net employment change should have a coefficient around one, and gross job destruction rates should have a small positive coefficient on average growth rate of each industry.

Prior analysis of industry-specific business failure rates[23] revealed that the industries that are dominated by non-profit or tax-exempt firms have much lower failure rates than similar industries. Subsequent examination of gross job creation and destruction rates for these industries showed those rates also to be substantially below rates for similar industries. These industries with a large proportion of employees in tax exempt organizations – such as many schools, charities, membership organizations, some hospitals – had particularly low job destruction rates. Apparently their protection from the forces of the market economy allow them to have much more stable employment levels than is typical of for-profit firms. LogTaxExempt measures the extent to which gross job flows are reduced in proportion to the share of tax-exempt firms in the affected service industries.

In many models of growth the reallocation of output and inputs across producers plays a critical role in economic growth (Aghion and Howitt, 1992). One class of vintage models emphasizes the role of entry and exit. If establishments cannot adopt new technology, growth occurs only via entry and exit, which requires input reallocation (Caballero and Hammour, 1994). This model contributes little to analysis of variation in

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[22] Births must be handled with a dummy to avoid distortion of the estimated coeffficients on age, which has a log-linear relationship to job flow rates for existing establishments.

[23] Tabulated from the LRD and reported by Al Nucci at the Center for Economic Studies of the U.S. Bureau of the Census.

birth rates, since it uses a Birth dummy to control for the non-linear effect of age=1. The coefficients on the Birth dummies[24] for each job flow equation will be the difference between the job flow rates predicted by the regression model, based on all of the other characteristics of the cells with births, and the actual job flow rates of the births.[25] We would expect Births to be positively related to job creation and negatively elated to job destruction, with values near 2.

The Multi-Unit dummy summarizes the differences between single-unit and multi-unit establishments' overall levels of the various growth rates when all of the other coefficients are constrained to be the same for single units and multi-units. The Services dummy, similarly, summarizes the differences between service sector and manufacturing sector establishments' overall levels of the various growth rates when all of the other coefficients are constrained to be the same for both sectors.

C. Regression Results

To test the hypothesis that relative wage differences have a disparate effect on employment growth an OLS regression, weighted by aggregate mean employment in each cell, was estimated for the 23,465 cells representing the entire population of service and manufacturing establishments between 1989 and 1995. The coefficients were estimated for gross job creation, for gross job destruction and for net employment

[24] All business births, by definition, have an age of one year and a job creation rate of 200 percent, since their initial employment is two times their mean employment because the calculation of their mean employment includes the zero value for the year before they are born. Furthermore, these births will have no job destruction in their birth year, so the dummy for births is needed also for that equation.

[25] Another way to view the meaning of the coefficients on the birth dummy is to visualize the shape of the estimated growth rate functions around the area of establishments with ages of 3 years and 2 years, and extrapolate back to what the predicted growth rate would be for one-year old establishments if they were not births. Then the value of each coefficient on the dummy indicates the difference between that rate and 2.00 for net and gross job creation and between that and zero for gross job destruction.

change. To test the hypothesis that differences in behavior of single- and multi-unit establishments account for much of the difference in employment growth, the regressions were re-estimated for each of 8 subsets of the cells, representing the different sector and firm type combinations. These results are presented in Tables 3, 4 and 5 for the entire population, and for each of the eight subpopulations. Nearly all coefficients were significant at the .0001 level, and the f-statistics of all equations were similarly strongly statistically significant.

The gross job creation regressions generally explain over 95% of the variation[26] in creation rates. The results for gross job destruction are not as strong as those for gross job creation. Although the overall patterns are similar among the four types of businesses, the proportion of variation explained is considerably lower for manufacturing than for services, and for multi-unit establishments compared to single-unit establishments.

The results for net job creation are estimated independently, but for most coefficients the values are both logically, and in fact, the arithmetic difference between those for gross creation and gross destruction. Since the estimated relationships were generally much stronger for gross job creation than for destruction, most of the coefficients for net employment growth are dominated by the patterns associated with gross job creation. Our model explained more than 90% of the variation in the annual net growth rates that were calculated as averages for the cells composed of establishments classified into different sizes, ages, types, and industries for different years. We will first examine the general patterns, based on regressions for both

[26] Of course, the largest variations are due to births, and these are fully accounted for with the Birth dummy, so the summary statistics should not be strictly interpreted.

industries and firm types altogether, using dummies to allow for differences in levels. These are summarized in the table and discussion below. After this overview, we will discuss the differences among the subpopulations, referencing the detailed results in Tables 3 to 5.

As expected, gross job creation is strongly negatively related to the log of establishment size. The log of establishment size was also weakly, but consistently, negatively related to gross destruction rates. The combined effect of these is a negative relationship to net job growth for both sectors and both firm types. The expected strong negative relationship to age of establishments was also found. The negative relationship of age to job destruction was slightly stronger than that for job creation, so that the joint effect of the falling expansion rates and the falling closure rates is a small positive impact of age on net growth rates.

Table 3

Regression Analysis of Gross Job Creation Rates in Services and Manufacturing

by Sector and Establishment/Firm Type

with t ratios shown below estimated coefficients, and < if significance is less than .05

n / Rsq'rd	Intercept	Log Empl	Log Age	Industry Rel.Pay	GDP Chg	Industry Growth	Log Tax Exempt	Birth Dummy	Multi-unit Dummy	Services Dummy
Both Sectors										
All types										
23465	**0.285**	**-0.020**	**-0.041**	**-0.006**	**0.371**	**0.891**	**-0.039**	**1.788**	**0.004**	**-0.025**
0.97	168.4	-89.3	-78.2	-4.27	14.1	35.1	-20.8	691.0	4.79	-16.5
Single units										
11232	**0.309**	**-0.016**	**-0.054**	**-0.015**	**0.287**	**1.123**	**-0.029**	**1.754**		**-0.045**
0.98	148.6	-60.3	-80.2	-8.54	8.28	34.1	-13.0	577.3		-23.4
Multi-units										
12232	**0.279**	**-0.024**	**-0.029**	**0.009**	**0.415**	**0.601**	**-0.045**	**1.825**		**-0.002**
0.96	103.8	-70.2	-37.3	4.25	11.0	16.1	-14.5	437.6		-0.74 <
Services										
All types										
10165	**0.243**	**-0.019**	**-0.041**	**-0.014**	**0.244**	**1.347**	**-0.045**	**1.781**	**0.005**	
0.97	99.0	-62.8	52.6	-6.89	5.96	36.0	-19.1	494.0	3.66	
Single units										
5001	**0.254**	**-0.015**	**-0.053**	**-0.018**	**0.158**	**1.326**	**-0.034**	**1.760**		
0.98	87.8	-42.4	-54.3	-7.35	3.15	29.2	-11.6	413.8		
Multi-units										
5163	**0.255**	**-0.025**	**-0.027**	**-0.000**	**0.332**	**1.303**	**-0.051**	**1.812**		
0.96	60.0	-49.8	-23.0	-0.14 <	5.18	22.0	-13.5	305.4		
Manufacturing										
All types										
13299	**0.285**	**-0.025**	**-0.038**	**0.009**	**0.555**	**-0.302**		**1.815**	**0.008**	
0.96	132.7	-70.9	-52.1	5.20	17.6	-8.52		454.9	6.48	
Single units										
6230	**0.323**	**-0.024**	**-0.055**	**0.004**	**0.700**	**-0.243**		**1.752**		
0.97	114.0	-48.2	-56.6	1.32 <	14.6	-4.19		366.8		
Multi-units										
7068	**0.270**	**-0.025**	**-0.027**	**0.013**	**0.484**	**-0.300**		**1.860**		
0.95	77.6	-52.6	-27.1	5.41	11.6	-6.50		307.3		

Source: Tabulations of annual gross changes in employment between 1989 and 1995 for all manufacturing and services establishments in the LEEM file constructed by the U.S. Bureau of the Census

Table 4

Regression Analysis of Gross Job Destruction Rates in Services and Manufacturing

by Sector and Establishment/Firm Type

with t ratios shown below estimated coefficients, and < if significance is less than .05

n / R sq'rd	Intercep	Log Empl	Log Age	Industry Rel.Pay	GDP Chg		Industry Growth	Log Tax Exempt	Birth Dummy	Multi-unit Dummy	Services Dummy
Both Sectors											
All types											
23465	**0.285**	**-0.003**	**-0.050**	**-0.036**	**-0.042**		**0.184**	**-0.150**	**-0.257**	**-0.027**	**0.022**
0.42	134.3	-11.9	-74.8	-20.9	-1.28	<	5.76	-63.0	-79.2	-24.2	11.8
Single units											
11232	**0.325**	**-0.002**	**-0.067**	**-0.050**	**-0.107**		**0.159**	**-0.138**	**-0.304**		**0.011**
0.52	114.3	-4.61	-72.60	-20.8	-2.26		3.53	-44.8	-73.1		4.24
Multi-units											
12232	**0.226**	**-0.005**	**-0.033**	**-0.020**	**-0.022**		**0.180**	**-0.159**	**-0.206**		**0.035**
0.31	70.4	-13.1	-35.8	-7.95	-0.49	<	4.05	-42.9	-41.5		13.5
Services											
All types											
10165	**0.284**	**-0.004**	**-0.048**	**-0.041**	**0.132**		**0.712**	**-0.155**	**-0.260**	**-0.025**	
0.49	92.8	-10.4	-49.7	-16.2	2.58		15.3	-52.7	-58.0	16.0	
Single units											
5001	**0.319**	**-0.002**	**-0.062**	**-0.041**	**0.019**		**0.405**	**-0.140**	**-0.295**		
0.60	88.2	-5.31	-51.4	-13.7	0.30	<	7.14	-38.8	-55.7		
Multi-units											
5163	**0.220**	**-0.006**	**-0.032**	**-0.039**	**0.243**		**1.106**	**-0.168**	**-0.216**		
0.38	41.2	-9.02	-21.3	-9.07	3.02		14.8	-35.2	-28.9		
Manufacturing											
All types											
13299	**0.288**	**-0.006**	**-0.048**	**-0.030**	**-0.338**		**-1.081**		**-0.241**	**-0.028**	
0.31	102.5	-12.1	-50.9	-12.6	-8.19		-23.3		-46.1	-17.2	
Single units											
6230	**0.353**	**-0.001**	**-0.079**	**-0.081**	**-0.494**		**-0.963**		**-0.332**		
0.37	73.0	-0.78	< -48.1	-16.7	-6.06		-9.74		-40.8		
Multi-units											
7068	**0.225**	**-0.008**	**-0.029**	**-0.006**	**-0.309**		**-1.054**		**-0.178**		
0.23	62.6	-17.1	-27.9	-2.26	-7.14		-22.0		-28.4		

Source: Tabulations of annual gross changes in employment between 1989 and 1995 for all manufacturing and services establishments in the LEEM file constructed by the U.S. Bureau of the Census, Dept. of Commerce.

Table 5

Regression Analysis of Net Job Creation Rates in Services and Manufacturing

by Sector and Establishment/Firm Type

with t ratios shown below estimated coefficients, and < if significance is less than .05

n / Rsq'rd	Intercept	Log Empl'ym'nt	Log Age	Industry Rel.Pay	GDP Chg	Industry Growth	Log Tax Exempt	Birth Dummy	Multi-unit Dummy	Services Dummy
Both Sectors										
All types										
23465	**-0.001**	**-0.016**	**0.008**	**0.030**	**0.413**	**0.707**	**0.111**	**2.045**	**0.031**	**-0.047**
0.92	-0.23 <	-45.5	9.65	13.5	9.58	17.1	35.7	483.8	21.5	-19.1
Single units										
11232	**-0.016**	**-0.014**	**0.013**	**0.035**	**0.394**	**0.963**	**0.108**	**2.057**		**-0.056**
0.94	-4.52	-31.0	11.0	11.5	6.53	16.8	27.7	389.1		-16.8
Multi-units										
12232	**0.053**	**-0.019**	**0.004**	**0.029**	**0.437**	**0.421**	**0.114**	**2.031**		**-0.037**
0.90	12.3	-33.8	3.30	8.49	7.16	6.99	22.7	301.2		-10.4
Services										
All types										
10165	**-0.041**	**-0.015**	**0.007**	**0.027**	**0.113**	**0.636**	**0.110**	**2.041**	**0.030**	
0.93	-10.2	-30.5	5.68	8.11	1.68 <	10.4	28.5	346.6	14.4	
Single units										
5001	**-0.065**	**-0.013**	**0.010**	**0.024**	**0.139**	**0.921**	**0.106**	**2.050**		
0.96	-13.9	-22.3	6.16	6.08	1.73 <	12.7	22.9	301.2		
Multi-units										
5163	**0.034**	**-0.019**	**0.005**	**0.038**	**0.088**	**0.198**	**0.117**	**2.028**		
0.90	4.77	-22.5	2.26	6.62	0.81 <	1.95 <	18.1	200.3		
Manufacturing										
All types										
13299	**-0.003**	**-0.019**	**0.010**	**0.039**	**0.893**	**0.778**		**2.056**	**0.036**	
0.89	-0.80	-31.7	8.38	12.5	16.3	12.6		296.4	16.6	
Single units										
6230	**-0.030**	**-0.024**	**0.025**	**0.084**	**1.194**	**0.720**		**2.084**		
0.89	-4.85	-21.8	11.8	13.9	11.6	5.78		203.1		
Multi-units										
7068	**0.044**	**-0.017**	**0.002**	**0.019**	**0.792**	**0.754**		**2.038**		
0.89	8.26	-22.6	1.20 <	5.03	12.3	10.6		218.5		

Source: Tabulations of annual gross changes in employment between 1989 and 1995 for all manufacturing and services establishments in the LEEM file constructed by the U.S. Bureau of the Census, Dept. of Commerce.

Controlling for age and size, we find that industries with higher average pay have very slightly lower job creation rates and substantially lower job destruction rates. The higher human capital embodied in more highly paid workers, and the probable higher cost of their training and replacement apparently serves as a deterrent to layoffs. The overall impact of relative pay on net employment growth rates is positive, but tiny.[27]

Summary of Estimated Coefficients

Explanatory variable	Job creation rates	Job destruct'n rates	Net growth rates	Weighted mean of explanatory variable
Log Employment	-.020	-.003	-.016	4.756
Log Age (years)	-.041	-.050	+.008	2.208
Industry Pay Diff.	-.006	-.036	+.030	Serv -.113, Manu .183
GDP Change	+.371	-.042	+.413	.018
Industry Growth	+.891	+.184	+.707	Serv .038, Manu -.008
Log Tax-Exempt	-.039	-.150	+.111	Serv .261
Multi-Unit dummy	+.004	-.027	+.031	Multi= 1
Service dummy	-.025	+.022	-.047	Service= 1

Source: Tables 3-5 All types, line one.

[27] Traditional models of wages assume that the labor supply curve is horizontal where additional workers can be hired at the existing wage. However, monopsony modes imply that wages must be raised whenever additional workers are hired, and firms have permanent vacancies at existing wages (Manning, 1995; Boal and Ransom, 1997; and FitzRoy, 1999). This implies that firms have permanent stocks of unfilled vacancies, jobs they would like to fill at the existing wage, which is less than marginal productivity. For empirical evidence see Acs, FitzRoy and Smith, 1998.

Variation in industry trend growth rates was expected to relate positively to each of the components of growth, with a coefficient greater than one for gross job creation rates and around one for net employment change. At this aggregated level, we find more moderate coefficients, with the industry trends not being fully reflected in the individual cell growth rates.[28] Rounding the coefficients indicates that about 90% of an industry's trend growth rate is reflected in its gross job creation rates, and 20% of its trend growth rate is reflected positively in its gross job destruction rates (causing higher destruction). Thus, only 70% of its growth trend is reflected in the net employment growth rate for a specific year.

Changes in GDP were positively related to both gross job creation and net employment growth, as expected. Prior research[29], based on much longer time periods, but generally limited to manufacturing employment changes, had found that the primary impact of the business cycle on job growth was through its countercyclical effect on job destruction. Therefore we expected the size of the negative coefficient on GDP change for gross job destruction to be larger than that for creation, but it was much smaller.

The lower reallocation rates for service industries with substantial portions of their employment in tax-exempt firms were attributed primarily to substantially lower gross job destruction rates, and secondarily to lower creation rates. Increases in their tax-exempt share were associated with higher net job growth, other things being equal.

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[28] Of course, we have separated total growth into a time-sensitive portion, which is the GDP Change, and an industry-sensitive portion, the Industry Growth variable. The joint effect of these together must reflect the actual long-term growth in each industry.

[29] See, for instance, Davis, Haltiwanger and Schuh (1996) pp. 31-34.

The coefficients on the multi-unit dummy indicate that when the regressions are constrained so that single- and multi-units are forced to have the same coefficients on all of the other attributes, the predicted growth rates for multi-units will differ by the coefficient from those of otherwise comparable single units. Thus, multi-unit job creation would be 0.4% points higher, destruction would be 2.7% points smaller, and net growth rates would be 3.1% points higher. Since average net growth rates for multi-units are, in reality, usually much lower than those for single units, differences between multi-units and single units in their age and size structure must account for their actual weaker growth rates. The coefficients on the services dummy reflect the effects of systematic differences by industry in the relative pay (where most services are lower than most manufacturing) and in trend industry growth rates (where most services are much higher than most manufacturing).

The disaggregated regression results in Tables 3 to 5 allow us to examine how the general relationships described above vary by industry and type of firm. Surprisingly, the most remarkable observation is the consistency of the estimates for coefficients on Employment size and Age, which together account for most of the differences in gross and net job flow rates. The impact of size on gross job creation was strikingly similar across all four types of businesses – single and multi-units in services, and single and multi-units in manufacturing. However, the gross flow rates for single units were twice as sensitive as multi-units to differences in Age.

Our first hypothesis, that the job flow rate differences between service and manufacturing could be accounted for primarily by the difference in their shares of multi-unit firm ownership, is not supported. Not only are the underlying job flow parameters

for single and multi-unit establishments nearly identical, but those for services and manufacturing are even closer to identical with respect to differences in age and size. *It is the underlying differences in establishment age and size distributions that must account for the substantial differences in the average gross and net job flow rates of the two industry sectors.*

After controlling for establishment size and age, and the industry growth rate, job creation is not strongly related to the relative average pay in these industries and firm types. There were small, but significant, coefficients indicating that gross job creation in single unit services establishments was higher in lower paid industries, while that in multi-unit manufacturing establishments was higher in higher paid industries. However, the estimated coefficients for gross job destruction were more substantial and consistent. For net employment change all four subpopulations had positive coefficients on relative pay, ranging from .019 to .084. This disproves our second hypothesis, that relative wage differentials have a disparate effect on employment growth for services and manufacturing. It also *effectively disproves the popular claim that the net growth in services is concentrated disproportionately in low skilled, low paying industries*, although the gross creation rate for single unit services is negatively related to relative pay. [30]

The positive relationship expected, and found, between gross job creation and the growth trend in each 2-digit industry, holds only among the service industries. For

[30] These results are also consistent with recent evidence showing that productivity was growing faster than originally reported between 1990-1995 in the service sector. On November 12, 1999 the Bureau of Labor Statistics released an upward revision of the productivity data, including software production for the first time as output and making other upgrades. The new data show average productivity growth in the 1990s, originally calculated at 1.5 percent annually, now at 2 percent. Between 1996-1999 average annual productivity growth in the non-agricultural sector of the economy has been growing at 2.6 percent.

manufacturing these coefficients were estimated to be small and negative. Since employment in most manufacturing industries was shrinking during this period, much of the gross job creation must be taking place in innovative niches within the shrinking 2-digit industries used here, so it cannot be accounted for properly at this level of analysis. Gross job destruction in manufacturing also had large negative coefficients on industry growth trends, while those for services were positive. [31]

Since only 7 years of annual data were available for analysis, we must be cautious in interpreting the coefficients on GDP change as indicators of cyclical behavior. However, we are fortunate that our time period incorporates both recession and growth periods, and our estimates are quite strong, so it seems reasonable to view the coefficients as representative of at least the most recent business cycle. While the summary parameters reported above were consistent with the literature that reports that gross job destruction is countercyclical, *we find this to be true only for manufacturing*. Services were far less sensitive to GDP changes, and both their creation and their destruction were positively related to GDP change. For each percentage point of GDP growth we estimate that services will increase job creation by 0.2% point and increase job destruction by 0.1% point, for a net job growth rate increase of 0.1%. In the same circumstances, manufacturing will increase job creation by 0.6 percentage point, *decrease* job destruction by 0.3%, and increase its net job growth rate by 0.9% point.

[31] Thus higher job loss rates were associated with both the faster shrinking manufacturing industries and the faster growing service industries. These relationships can be illustrated by comparing the impacts of an industry growth trend of 1%. In services this would be associated with a 1.3 percentage point increase in gross job creation and a 0.7 point increase in job destruction, for a net change of 0.6%. The same attribute in manufacturing would be associated with a 0.3 point decrease in job creation and a 1.1 point reduction in job destruction, for a very similar increase in net change of 0.8%. However, almost all manufacturing industries had negative trend growth rates, so the impacts would be reversed.

These fairly striking industry sector differences in the effects of industry growth trends and of GDP change on patterns of job creation and destruction overshadowed the differences between firm types. So again, our hypothesis that firm type effects would account for industry differences is not supported. In both of these respects, service establishments clearly behave differently than manufacturing establishments that are similar in other respects.

Finally, the positive and statistically significant coefficient on Births for job creation and net growth suggests that births (entry of new establishments in single and multi-unit firms) play an important role in the reallocation process (Caballero and Hammour, 1994 and 1996; Campbell, 1997).[32]

V. Persistence of New Jobs in Services and Manufacturing

A. Persistence differences for births and expansions

The persistence of new jobs refers to the extent to which job creation endures (is not reversed) in subsequent years. High rates of job creation are viewed as desirable if they result in high net growth rates, or if they are the result of adaptation to technological or demand changes, even when offset by high rates of job destruction in other establishments. But the same high job creation rates are viewed as undesirable if a large proportion of those new jobs are lost within the next few years. Analyzing the fraction of newly created jobs that are destroyed in subsequent years provides a way to identify types of establishments or sectors whose new jobs are less stable than average.

[32] Dropping births reduces the explanatory power of the regressions by about one-third.

Before we discuss the persistence of new jobs, it would be helpful to note what industrial organization economists have to say about entry. According to Geroski (1995, 435), "…perhaps the most striking thing that we know about entry is that small scale, de novo entry seems to be relatively common in most industries, but that small-scale, de novo entrants generally have a rather short life expectancy. That is, entry appears to be relatively easy, but survival is not. The most palpable consequence of entry is exit, and industries that exhibit high entry rates often also exhibit a high degree of churn at the bottom of the size distribution." Since entry is often easy but survival is not, it is difficult to reconcile high entry barriers with high entry rates. However, if high entry barriers are thought of as preventing firms from surviving and growing then the empirical puzzle is less of a puzzle. We therefore would expect persistence rates (survival of new jobs) to be lower in births than in expansions. If we accept the popular assumption that job quality is lower in services than in manufacturing, we would also expect persistence rates to be lower in services than in manufacturing. Persistence rates for new jobs in multi-unit establishments should be higher than those in single unit establishments, because of the more professional management and greater financial resources typical of multi-unit establishments.

We follow Davis, Haltiwanger and Schuh (1996) in defining the n-year persistence of job creation as the percentage of newly created jobs at time t that remain filled[33] at each subsequent year through t+n.[34] This is calculated for each category of

[33] The LEEM provides only the actual number of employees in March of each year, and we measure job creation as the sum of the net increases over a year for the establishments that increased their employment (from zero for births, and from a positive number for expansions). Thus we cannot determine whether any particular new position has been retained with an employee holding it – we can only determine the extent to which overall employment in the establishment is reduced, reversing part or all of the original job creation.

establishments, for each year of job creation, t, by summing the number, P(n), of new jobs that persist in year n, and dividing by the sum of the newly created jobs from year t. If an establishment's employment, E(t), is greater than its prior year employment, E(t-1), then it has created E(t) – E(t-1)= ΔE(t) jobs in year t. The number of new jobs that persist in a subsequent year t+n is:

(7) P(t,n) = min [E(t)-E(t-1), E(t+1)-E(t-1), …, E(t+n)-E(t-1)].

The n-year persistent rate for jobs created in year t is then:

p(t,n) = P(t,n) / ΔE(t).

We calculate persistence of new jobs separately for establishment births, where E(t-1) is zero and all jobs in year t are new jobs, and for expansions, where E(t-1) is positive, but smaller than E(t).

Figure 1 shows the average persistence over the subsequent four years of new jobs that were created in 1989-90 and 1990-91. The higher pair of lines represents the decreasing fraction of jobs from births that remain in each of the subsequent years following the startup of a new establishment. For new jobs from manufacturing births, this proportion ranges from around 74% surviving one year[35] down to about 47% surviving throughout 4 subsequent years. The comparable persistence rates for jobs created by service establishment births run a few points lower, probably reflecting lower capital requirements (and therefore fewer sunk costs and lower potential losses from failure) for service business startups. These rates are actually very close

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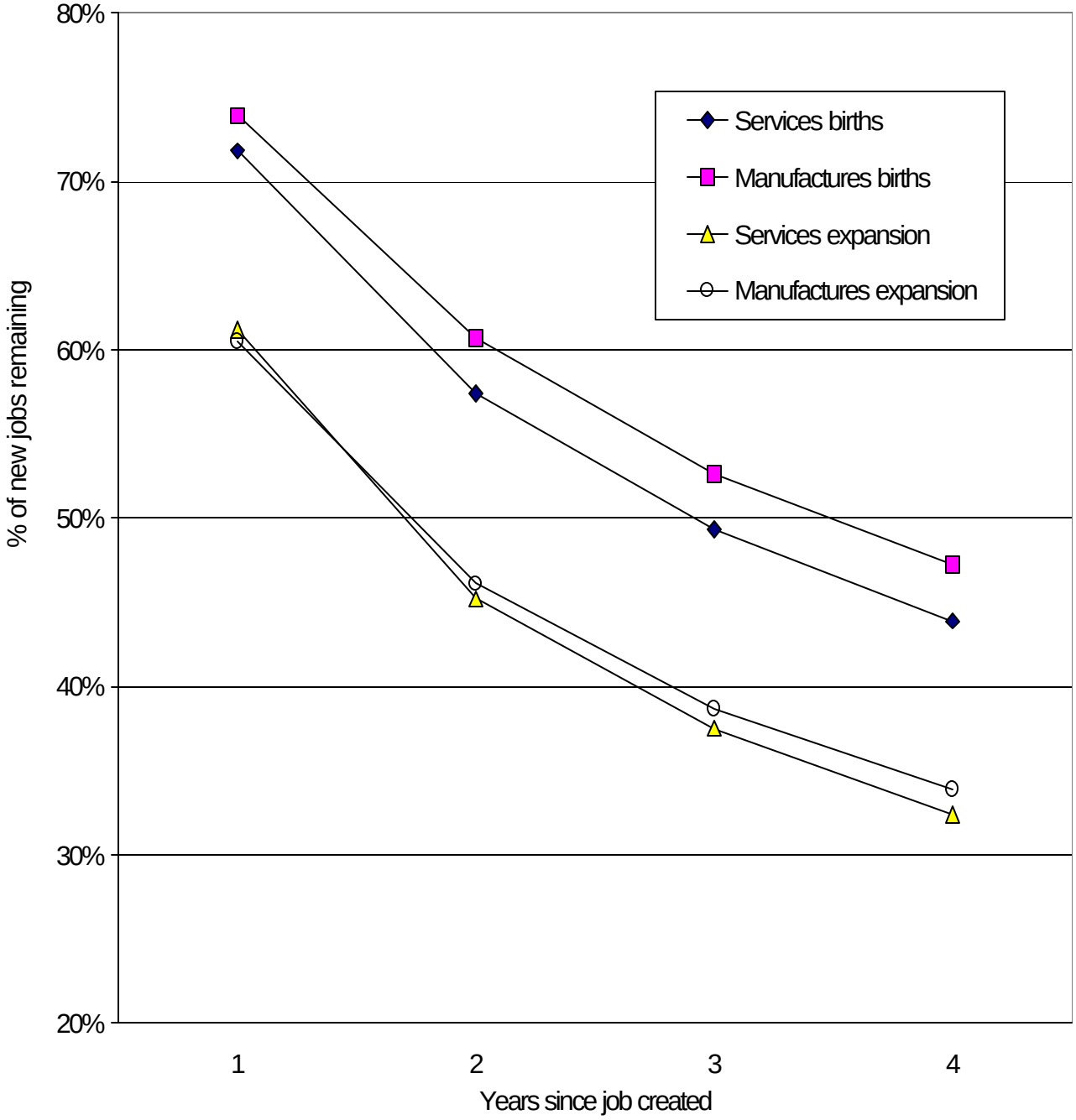
[34] Their average one and two-year persistence rates for job creation in manufacturing between 1972 and 1988, calculated from LRD data, are nearly identical to our calculations for manufacturing for 1989 through 1993.

[35] Actually, 1 to 2 years after their original positive employment, because the LEEM only contains March employment for each year. Thus a business that began with employment in April 1989 would not be counted as a birth until March 1990, and its persistence would be calculated as the fraction of its March 1990 employment that was still there in March 1991.

Figure 1
Average Persistence of Jobs Created in 1989-1991
over Next 1 to 4 Years



Source: Tabulation of the 1989-1995 Longitudinal Establishment and Enterprise (LEEM) file, which was prepared by the Bureau of the Census, U.S. Department of Commerce.

to the business survival rates reported by Bates and Nucci (1989) and others, suggesting that most jobs lost soon after a business starts up are associated with its failure, and subsequent closure.

The persistence of new jobs from expansions was substantially lower than that from births, ranging from 61% for a single year for both industries, down to 34% for manufacturing jobs and 32% for service jobs after 4 years. This finding was quite surprising, because it is commonly assumed that new jobs in new businesses are much riskier than new jobs in existing businesses, due to the relatively high failure rates of young businesses. However, apparently those new establishments that survive rarely reduce their employment from their starting size, so there is little downside risk other than failure.

B. Persistence differences by size and type

We expected the persistence of new jobs from business births to increase with the original size of the business, because of their probable higher sunk costs of startup capital and planning time. But this was not generally true, as can be seen in Table 6. The majority of service employment is in single units and the majority of manufacturing employment is in multi-unit establishments, and both of these categories showed nearly constant persistence rates across various size classes, with only slight increases in the largest size class. Even more surprisingly, the one-year persistence rates for new jobs from births of both multi-unit service establishments and single unit manufacturing establishments fell with increasing size at startup.[36]

[36] In future work we will investigate whether these decreasing persistence rates are due primarily to higher failure rates for these larger new establishments, or to reductions after the first year in the employment levels of surviving establishments. This latter case might occur when a business either

Table 6 also shows that the one-year persistence rates of new jobs from expansion of existing establishments exhibit little variation by industry, by establishment type, or by establishment size class. Nearly all of the rates fall between 62% and 66%, indicating that about a third of the new jobs in expansions are lost by the subsequent year, regardless of category of business. The only exception to this was the higher rate for the class of very large multi-unit service establishments. This class of businesses is probably dominated by large schools and hospitals, which are predominately non-profit

Table 6
Average Annual One-year Persistence of Jobs Created in 1989-1993
by Sector, Establishment Type and Establishment Size
% of jobs created annually which remain in the following year

	New jobs in establ.births		New jobs in expansions	
	Single unit	Multi-unit	Single unit	Multi-unit
Services establishments				
Total	**70.7%**	**77.1%**	**60.7%**	**64.9%**
1-19 employees	70.6%	83.9%	59.2%	62.2%
20-99	69.3%	79.5%	62.4%	63.3%
100-499	70.7%	77.4%	61.7%	62.7%
500 or more	73.3%	67.5%	64.8%	72.7%
Manufacturing establishments				
Total	**64.0%**	**81.3%**	**61.4%**	**65.5%**
1-19 employees	68.8%	81.0%	59.7%	63.5%
20-99	66.5%	81.3%	61.6%	66.4%
100-499	56.0%	80.3%	64.2%	65.8%
500 or more	37.5%	82.5%	68.0%	64.8%

Source: Tabulation of the 1989-1995 Longitudinal Establishment and Enterprise (LEEM) file, which was prepared by the Bureau of the Census, U.S. Department of Commerce.

increased the productivity of the remaining employees or reduced the scale of its operations from its

institutions. Most non-profits have very low job reallocation rates, and therefore have lower probabilities of job losses, especially right after they have expanded.

As expected, the persistence rates for multi-unit establishments were generally higher than those for single units, reflecting a higher level of both management experience and capital resources in (the headquarters of) many multi-unit firms. However, even after controlling for firm-type, the persistence rate differed by industry. The direction of these differences varied for new jobs from births and for new jobs from expansions. *Thus our hypothesis that industry differences in persistence rates would be fully accounted for by the differences in firm types is not supported*.[37]

VI. Conclusions

We have shown that much of the concern about the dynamics of the service sector that has been expressed by economists and policy makers on both sides of the Atlantic has little justification. It appears that the substantial differences in job flow rates in services and manufacturing are associated primarily with the differences in the age and size of establishments in the two sectors. These sectors were also remarkably similar in the quality of jobs they are generating – in terms of both relative pay and stability of new jobs.

The conventional wisdom has been that the growth in service businesses generates predominantly unstable and low-wage jobs, in contrast to the stable, high-

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planned startup size.

[37] A complex calculation of expected persistence rates for all jobs, for comparison with actual persistence of new jobs from expansions, shows that the new jobs from expansions are more likely than to survive than the average job is. The differences are greater for manufacturing than for services, and greatest for expanding branch plants in manufacturing.

wage jobs associated with manufacturing. To test these assumptions, we have used Census microdata that allow us to track the employment and ownership of all U.S. businesses with employees, from 1989 through 1995. These data facilitate consistent and comprehensive analysis of gross and net job flows and the persistence of new jobs in the service sector in comparison to the manufacturing sector.

We find that the job flow rate differences between service and manufacturing could not be accounted for primarily by the difference in their shares of multi-unit firm ownership. The underlying job flow parameters for single and multi-unit establishments are very similar, and those for services and manufacturing are nearly identical with respect to differences in age and size. It is the underlying differences in establishment age and size distributions that apparently account for the substantial differences in the average gross and net job flow rates of these two industry sectors. In other words, the fairly astonishing rate of growth in U.S. services is associated with continued high rates of entrepreneurship, both by independent owner/proprietors and by management of multi-unit firms. These new businesses contribute doubly to growth -- not only their original new jobs at startup, but also their typically higher growth rates over their next several years of development, relative to older businesses.

Moreover, we found that relative wage differentials have similar effects on job flows in manufacturing and services. Industries with higher average pay have very slightly lower job creation rates and substantially lower job destruction rates. These results were robust with respect to both type of firm and industry sector. In effect, the U.S. economy has been creating jobs at all levels of industry pay, while destroying jobs predominantly in low wage industries, not high wage industries. This effectively

disproves the common claim that the growth in services is concentrated disproportionately in low skilled, low paying industries.

If we accept the conventional wisdom that job quality is lower in services than in manufacturing, we would expect the proportion of new service jobs that survive multiple years to be much lower than that of new manufacturing jobs. However, our results suggest that services on average are creating jobs that are nearly as stable as new jobs in the manufacturing sector. The persistence of jobs created by new service establishments is a few points lower than that from new manufacturing establishments, probably reflecting generally lower capital requirements for service startups.

In both sectors, the persistence of job gains from births was much greater than that from expansion of existing establishments, even after four years. This finding was quite surprising, because it is commonly assumed that new jobs in new businesses are much riskier than new jobs in existing businesses, due to the relatively high failure rates of young businesses.

Persistence rates for new jobs in multi-unit establishments should be higher than those in single unit establishments, because of the more professional management and greater financial resources typical of multi-unit establishments. This was found to be the case for both sectors, and for both components of job creation.

These findings have implications that may be important for both theory and public policy. First, the recent evidence on increases in productivity growth in services, as well as in manufacturing, suggests that the service sector is more robust then was previously thought. The results in this paper are consistent with those findings. Second, more work is needed to bridge the gaps between labor economics and industrial

organization pertaining to issues of post-entry performance. Third, the distinction between professional management in multi-plant firms vs owner/proprietor in single unit firms may be less important that is commonly thought. Entrepreneurship appears to be playing an important role in creating jobs in single and multi-unit establishments alike.

From a public policy perspective there are two important findings. First, the fears about job quality and job stability in the service sector may be unfounded. Second, in order to create new jobs in the service sector countries must also increase the supply of entrepreneurs and foster the conditions in which they can create jobs.

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